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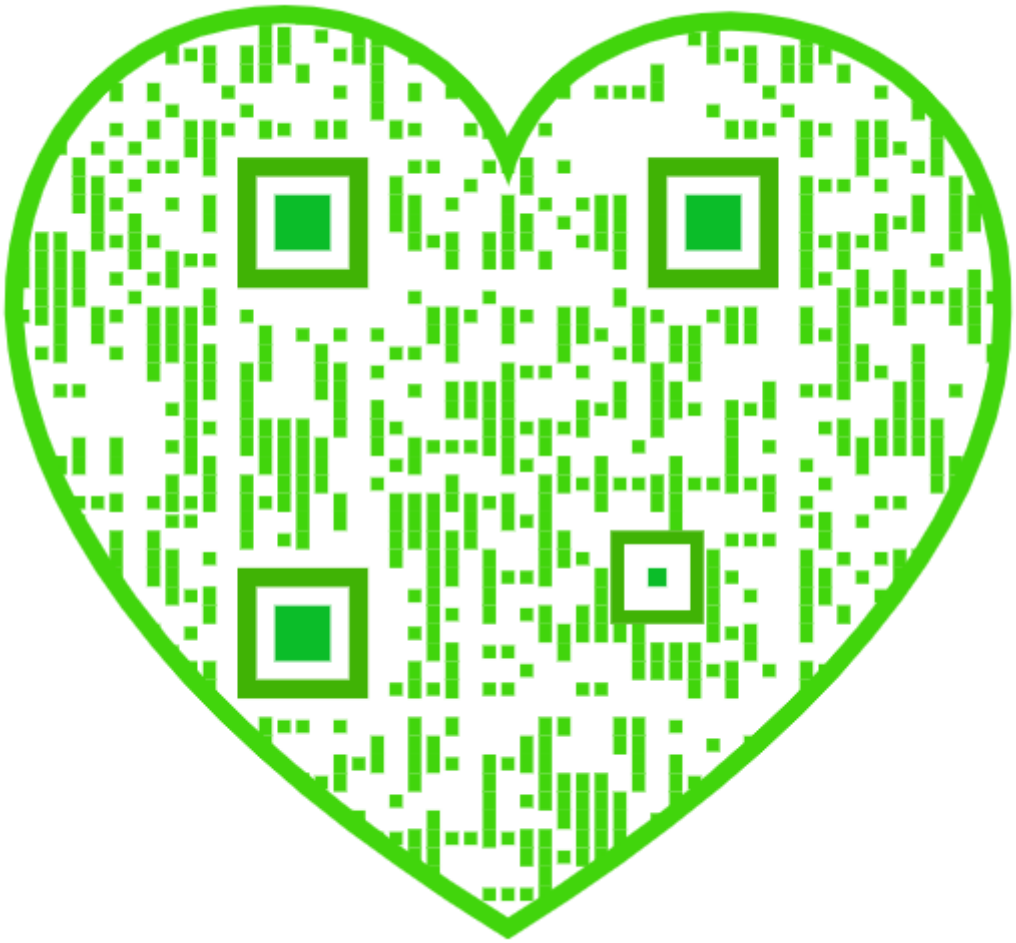

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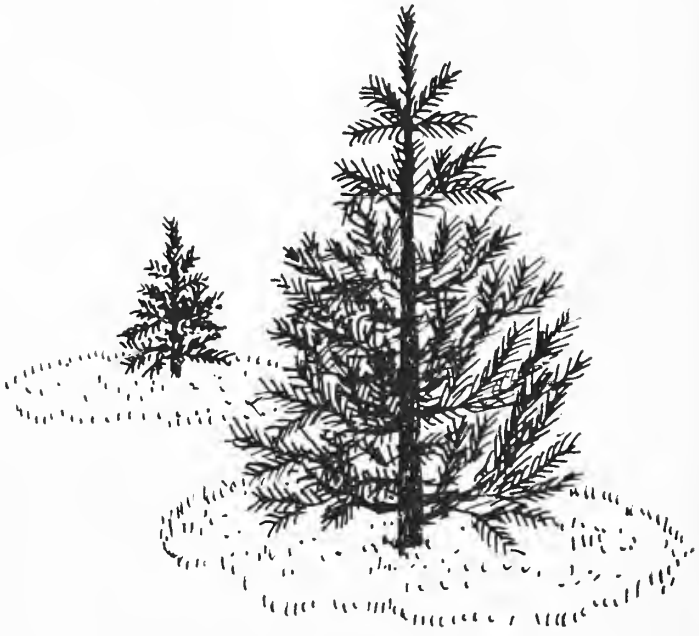
CARE FOR YOUR TREES

Plantation, Windbreak, Shade, and Christmas Trees

By W. F. Bulkley



University of Illinois at Urbana-Champaign
Cooperative Extension Service

College of Agriculture
Circular 1059

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CARE FOR YOUR TREES

TREES, like house plants or farm crops, need care. They cannot be neglected if they are to grow thriftily or be productive. This circular discusses the following practices in properly caring for shade trees, windbreak trees, and plantation-grown pines:

- How to protect trees from fire, animals, insects, and diseases.
- How to weed out undesirable trees that interfere with the growth of more valuable plantings.
- How to prune branches from pine trees to grow valuable knot-free wood.
- How to fertilize, water, and care for windbreak or shade trees to make them grow more thriftily.
- How to shear Christmas trees.

PROTECTION OF TREES

Protecting Trees from Fire

Fire can be the worst enemy of trees. When grasses and weeds are very dry, a fire can start easily. Wind spreads the fire and flames quickly move into the lower limbs of pine and evergreen trees. When fire reaches them, these trees often seem to explode because their needles and wood contain resin. Pine trees and other evergreens may be easily killed by flames or lose their beauty and thriftiness when needles on the lower limbs are destroyed by fire. Burned hardwood trees usually produce worthless multiple leaders from sprouts near the ground line.

The key to avoiding fires in forest plantations is prevention. Fires should not be lit under or near shade trees to keep the trees from being injured or killed. Signs warning hunters and smokers of the danger of fire should be erected along the boundaries of the plantation. Post signs along roads, trails, and fences where they will be easily seen. Signs can be homemade or they can be obtained from the district forester or fire warden of the State Conservation Department. If you have to burn brush piles, limbs, or debris near a tree plantation, make a fireline around the material to be burned and start the fire when the humidity is fairly high and the air still. In the winter, snow can be used to control the fire. Fire-fighting tools and water should be readily available to extinguish any fire that might get out of hand.

Forest plantings and windbreaks should be protected by firelanes. A firelane should be at least 10 feet wide. Firelanes should be built before

the early spring fire season and the cleared strip should be kept open through the dry summer and fall periods.

Protecting Trees from Livestock

Livestock often cause serious damage to trees. They chew off the bark, chew twigs and leaves, trample young trees, break off branches, and injure roots near the surface of the ground. Their hoofs also compact the soil, which is detrimental to root growth. Livestock can also be poisoned by feeding on some species of trees.

For these reasons livestock should be kept out of forest plantations even though there may be grasses and other plants suitable for forage growing among the trees (Fig. 1). Fences and gates protecting the plantation should be kept in good condition. Chickens should also be kept from roosting or feeding in windbreaks because their droppings and their feeding on buds and new growth are very harmful to trees.

Protecting Trees from Rabbits and Mice

Rabbits damage small trees by cutting off the tops of seedlings or main branches. They also girdle deciduous trees in plantations causing multiple leaders to grow. This results in a very poor survival rate for trees or a setback of tree growth. Injury to trees by rabbits can be reduced by mowing grasses and weeds in young plantations in the fall. If the grasses and weeds

Trees on farmland should be protected from damage by livestock by a fence such as the one shown above that keeps the Angus steer away from the red pine.

(Fig.1)

that rabbits like are not available in the plantation, the rabbits will tend to stay away from the young trees. Rabbits can also be controlled with commercially available repellents or they can be trapped. In extreme cases, and where safe and permissible, it may be necessary to shoot rabbits if damage is excessive.

Mice and other burrowing rodents also may injure trees. They chew off the roots of newly planted trees and chew the bark at the base of tree trunks. This girdles the trunk and eventually kills the tree. Watch for mouse runways in grass or weeds near trees and examine dead trees for mouse damage at the roots and the base of the trunk. If you find extensive mouse damage, put baited traps in the runways.

Protecting Trees from Insects

Many kinds of insects cause serious damage to trees. They can chew the needles or leaves, leaving bare twigs and weakening the trees to the point where they are subject to further infestation and eventually die. Aphids can suck sap from new shoots and leaves causing them to wilt or grow abnormally. Scale insects can encrust themselves on branches and twigs depriving the tree of food and causing its death. Borers tunnel into the wood causing deformities or killing the tree. Some insects can carry diseases to healthy trees and cause serious damage throughout the entire plantation.

Watering and fertilizing trees will often help them to overcome insect infestations. If they are detected in time, most species of insects can be controlled before they cause serious injury to trees. Watch for insects especially during April, May, and June. Most insects that are found on trees can be easily identified. Circular 746, Knowing and Controlling Insects, is useful in identification. If an insect cannot be easily identified, the county extension adviser should be consulted. If possible, the insect should be kept alive until the extension adviser examines it. A sample of the leaf or twig that the insect has injured will also help in insect identification.

Control measures should be considered after the insect has been identified. Eight groups of insects and representative insects in each group as well as some control measures for each are given below. One insect in each group is described in detail and some insecticides are mentioned for each case. For more specific recommendations consult Circular 900, Insect Control by the Homeowner. This circular is revised annually in December so be sure to get the latest edition.

Evergreen defoliators. These are insects that attack the foliage of evergreen trees. Three examples of this type of insect are the bagworm,

the sawfly, and the grasshopper. The bagworm is especially injurious to junipers and arborvitae. Pines are only occasionally infested by bagworms. All deciduous trees such as oak, cherry, and ash are occasionally infested by bagworms. Figure 2 shows bagworms on a juniper branch.

In Illinois, bagworm eggs hatch in late May and early June. The larvae are small for the first ten days or two weeks and are hard to locate. As the larvae grow, they begin to build bags from material taken from the host tree. If bagworms are allowed to feed for an extended time, they will strip a tree of its foliage and eventually kill it. Several spruce species are attacked by bagworms. If there are only a few worms present and the infested trees are small, pick off the bags and destroy them. Otherwise, a spray such as carbaryl, diazinon, or malathion should be used. Spray as soon as bagworms are noticed, but no later than June 15 to prevent serious injury. Avoid using malathion on Canaert junipers because it can cause the foliage to turn brown and die.

Twig and shoot borers. These insects bore into the shoots or twigs of pine trees. Examples of borers are the European pine shoot moth, the Nantucket tip moth, and the white pine weevil. The European pine shoot moth larvae appear in about mid-April on the twigs and shoots of pine

Bagworms on a juniper (red cedar) twig. Bags are shown about ¾ natural adult size. Each bag contains one larva. Continued feeding will leave the twig practically bare. (Fig. 2)

Injuries to the bud and end of twig of a red pine caused by European pine shoot moth. Resin can be seen oozing from the tunnels made by the larva. Needles at the end of the twig turn brown and die upon infestation. Dead buds are the result, causing the twig to die back and disfiguring the appearance of the red pine. (Fig. 3)

trees. They first chew on the needles and then bore into the twigs and buds. The needles of the newly infested shoots turn brown making the injury quickly noticeable. Figure 3 shows injury caused by the European pine shoot moth. The larvae change into pupae and emerge in June as adult moths to lay eggs for the second brood.

Shearing new shoots in June tends to reduce injury. If sprays are used, they must be applied to coincide with the feeding periods of the larvae on the needles in order to be effective. Spray the ends of the branches in mid-April for the first brood and in late June or early July for the second brood. Sprays that can be used include dimethoate and malathion.

Needle suckers. This type of insect sucks juices from the needles and foliage of spruces, arborvitaes, and junipers. This causes the needles and foliage to first turn gray and then brown as they die. Heavy infestations often kill entire branches. Examples of the needle and bark suckers are the red spider mite, the arborvitae leaf miner, the juniper scale, the Cooley spruce gall aphid, and the eastern spruce gall aphid. The red spider mite is a prime example of this group of leaf-sucking insects. Because these mites

Red spider mites can be detected by shaking a branch while holding a piece of white paper underneath it. (Fig. 4)

are very small, less than 1/50th inch long, they can only be detected by shaking the twig or branch that is thought to be infested over a sheet of paper (Fig. 4). If mites are present, they will fall on to the paper and will be seen moving about on it. The mites are green, red, or black and appear in April or early May. They produce several generations a year.

A spray should be applied when mites are first noticed. For best results, spraying should be done before June 15. The spray should be applied to the undersides of the needles. The treatment should be repeated in about a month if mites are still present. Sprays for controlling red spider mites include aramite, dicofol, and chlorobenzilate.

Leaf chewers. This group of insects includes the eastern tent caterpillar, the catalpa sphinx, the fall webworm, the May beetle, the poplar tent maker, the spring cankerworm, the yellow-necked caterpillar, the walnut caterpillar, the white-marked tussock moth, and the mimosa webworm on honeylocust.

The eastern tent caterpillar, a black, hairy insect, is commonly seen on wild cherry, elm, maple, and oak trees. It hatches in March from overwintered egg masses that are attached to twigs and look like a band or collar. The insect selects a fork of a branch to build its web-like nest. During the day it leaves the nest to feed on tree leaves (Fig. 5). After about five weeks of feeding, the caterpillar spins a cocoon, forms a pupa, and

Eastern tent caterpillars feeding on boxelder leaves. Numerous caterpillars can be seen on the upper leaves. The lower leaves have been completely skeletonized. (Fig. 5)

emerges as an adult during the summer. Approximately every ten years the insect has a sharp rise in population.

Leaves of shade trees that are infested with eastern tent caterpillars or other leaf chewers should be sprayed. Sprays that can be used include carbaryl and malathion.

Leaf miners and skeletonizers. These insects attack the leaves of deciduous trees. Among the insects in this group are the oak leaf miner, the birch skeletonizer, the cottonwood leaf beetle, the elm leaf beetle, and the hawthorn leaf miner.

The oak leaf miner feeds on the leaves of oak trees. The leaves become blotched and eventually die (Fig. 6). Sometimes the larvae can be seen at work between the upper and lower surfaces of the leaves when the leaves are held up to a very bright light. Usually no control is attempted because the injuries do not materially affect growth of the trees.

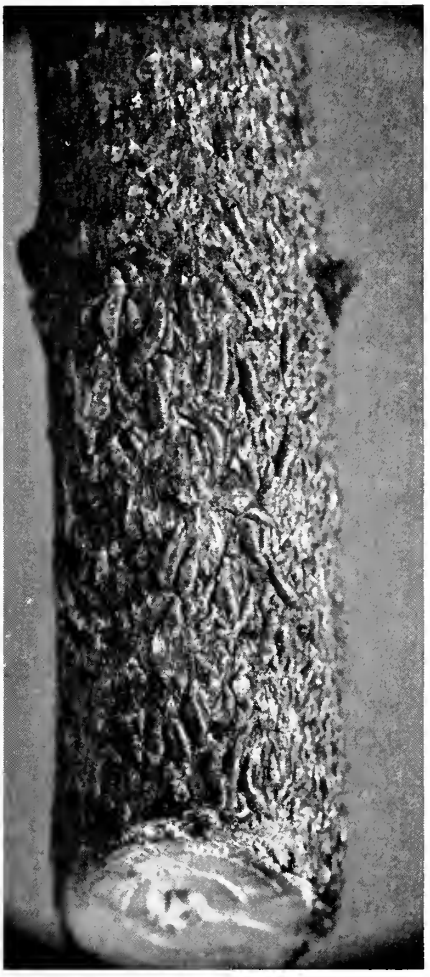
Bark and leaf suckers. The bark-sucking insects in this group include the oystershell scale, the cottony maple scale, the sweetgum scale, the European elm scale, the tuliptree scale, and the San Jose scale. Leaf suckers

Typical spot damage of the oak leaf miner on a bur oak leaf. Other species of leaf miners leave leaves completely skeletonized with only veins left. (Fig. 6)

include the boxelder aphid, the boxelder bug, the cockscomb gall aphid, the European red mite, the sycamore lace bug, the tuliptree aphid, and the wooley elm aphid.

The oystershell scale resembles an oyster shell in shape. It is so small that a magnifying glass is needed to see it. The insect can be found on the twigs and branches of several types of trees where it feeds by forcing its beak into the inner bark for sap (Fig. 7). Two broods are produced each year and dense populations often cause serious injury.

Bark and leaf suckers are sometimes difficult to control. For control of oystershell scale, malathion should be applied as a spray in early June and again in early August for best results.



This enlarged view of a small twig stem shows a dense infestation of oystershell scale. The mature scale insects have a shell protecting their bodies. (Fig. 7)

Borers and twig pruners. Insects included in this group are the red-headed ash borer, the bronze birchwood borer, the dogwood borer, the elm borer, the small European bark beetle, the hickory bark beetle, the locust borer, the oak twig pruner, and the poplar borer.

The grub of the red-headed ash borer attacks small ash trees by tunneling into the sapwood. As a result, sometimes the trunk of the tree breaks. The grub continues to grow throughout the summer and fall, pupates in late winter, and emerges as an adult beetle the following summer. Figure 8 shows the insect in its various stages.

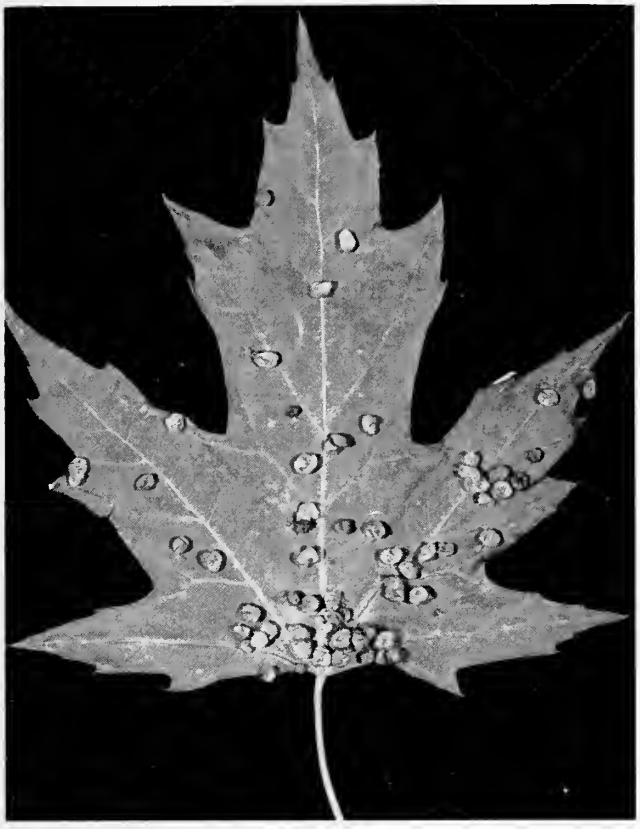
The other insects listed above attack a variety of trees in a similar manner. Control measures include preventing the borers from entering the tree trunks. Wrap trunks and large branches of newly planted trees with special tree-wrapping paper and keep the trees watered. Dimethoate

Stages in the life of the red-headed ash borer. A — the adult beetles. B — a larva (grub) feeding. C — an adult starting to emerge from the pupal case in the tunnel. D — furrows made by larvae in sapwood with holes made by adults as they emerge. (Fig. 8)

spray can also be used, but avoid spraying the leaves. If borers are already in the tunnels, and the tree still has thrifty leaves, clean the borings out of the tunnels with a wire. Then inject nicotine sulphate or carbon disulfide with an oil can. Plug the opening with putty to prevent the insecticide from escaping.

Gall makers. This group of insects, which attacks the leaves of deciduous trees, includes the maple bladder gall mite, the hackberry nipple gall, the hickory gall phylloxera, the oak gall, and the oak kermes.

The maple bladder gall mite produces unsightly greenish or reddish projections or galls on the upper sides of leaves of maple trees (Fig. 9). The galls are about ⅛ inch in diameter and about ⅛ inch high. Mites overwinter in the bark and move to newly formed leaves in the spring.



Bladder galls on a maple leaf. They are caused by very small mites and only disfigure the leaf, causing no real damage to the tree. (Fig. 9)

Control of the mites is difficult. If control is desired and is to be at all effective, malathion spray must be applied in the early spring before buds begin to swell.

Tree Diseases

Leaf diseases. These diseases, found on almost all species of deciduous trees, are caused by fungi. Leaf spots disfigure leaves (Fig. 10) but do not usually seriously affect a tree's thriftiness or growth. However, control is important on ornamental trees where thrifty appearance of the leaves is desirable. Other fungus diseases that are similar to leaf spots include blotches and blights. Horsechestnut leaf blotch and sycamore anthracnose are examples.

Leaf rust diseases. Rusts are found on the needles of evergreen trees such as junipers (Fig. 11) and pines and the leaves of deciduous trees such as crabapples. Rusts are usually brownish orange. Usually, no control of rusts is attempted. To avoid rusts on junipers, do not plant them close to hawthorns or crabapples.

A sugar maple leaf with tips of the lobes turned brown by an anthracnose fungus. Leaf spot fungi also cause irregularly shaped blotches in other tree species. (Fig. 10)

Cedar apple rust on a juniper twig. Spores developed from finger-like "horns" in the depressions spreading the disease to apple and crab trees from which it returns to nearby red cedars and junipers. (Fig. 11)

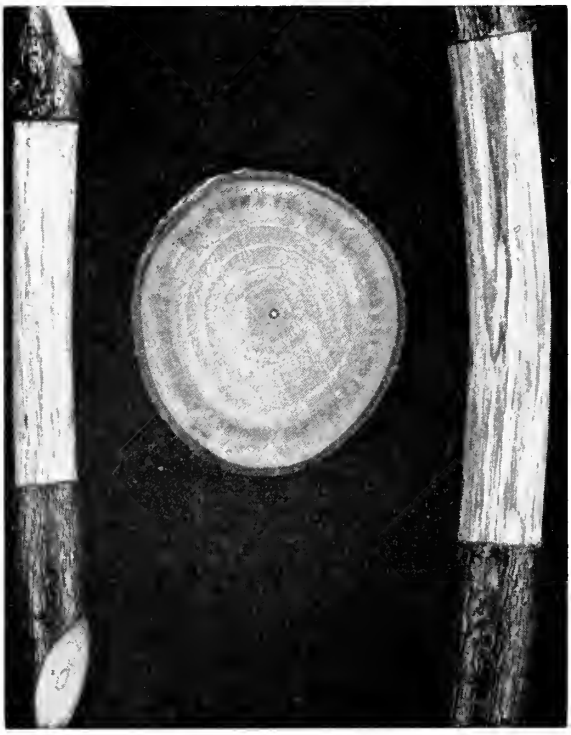
Canker diseases. Cankers kill the inner bark and the growing cambium tissues. They start as small elongated areas and then become larger, eventually girdling the trunk or branch (Fig. 12). The bark dries, shrinks, and becomes covered with the fruiting bodies of the fungus that caused the canker. Branches with cankers can be removed and cankers on the trunk can be eliminated by removing the diseased bark containing the

The canker on this poplar tree trunk has been cut back to show the dead dark sapwood. If the fungus is not checked, it will spread and eventually cause the death of the entire trunk. (Fig. 12)

fungus. Surgery is usually only successful if less than one-half of trunk bark is affected on young trees. The bark should be removed ½ to 1 inch beyond all discolored areas to be sure all infected areas have been treated. The surface should be disinfected with alcohol to sterilize the bark edges and wood so that the canker will not recur. After the disinfectant has dried, a good wound dressing should be applied. Use of paints should be avoided.

Wood rot. All species of trees are susceptible to wood rot. Fungus spores can lodge to start decay wherever bark has been removed exposing the sapwood. If decay is allowed to continue over a period of months, the tree trunk will become more susceptible to breakage. For this reason all tree wounds should be disinfected and painted with a dressing containing disinfectant. Use rubbing alcohol as a disinfectant, and an asphalt wound dressing.

Vascular diseases. This group of diseases includes Dutch elm disease, oak wilt, and Verticillium wilt. Many shade and forest trees have fallen victim to these diseases. They attack the vascular system of the tree which consists of liquid-conducting tissues that carry nutrients and food between the roots and the leaves. Eventually these tissues are unable to perform



Three views of twigs afflicted with Dutch elm disease. The twig on the left shows light streaking indicating the early stage of the disease. The sapwood of the twig on the right has been heavily streaked by fungus, indicating an advanced stage of the disease. The dark ring in the cross-section of the small twig shown in the center is also symptomatic of Dutch elm disease. The fungus that creates this ring blocks vital vessels in the twig and prevents passage of food and liquid necessary for the tree's survival.

(Fig. 13)

The large American elm limb in the left part of the illustration has dying brown leaves caused by the Dutch elm disease fungus.
(Fig. 14)

their function and the tree dies. The diseases are usually spread by adjoining trees making contact through grafted roots. Entire plantations or groups of trees can be quickly destroyed in this way.

Once Dutch elm disease (Figs. 13 and 14) or oak wilt has infected a tree, there is no control that will save the tree. Root-graft spread of these diseases can only be stopped by trenching or killing nearby healthy trees. Because Verticillium is a soil organism that usually invades a tree through its roots, removal of infected or wilting branches will not prevent the tree's death.

Other Hazards to Trees

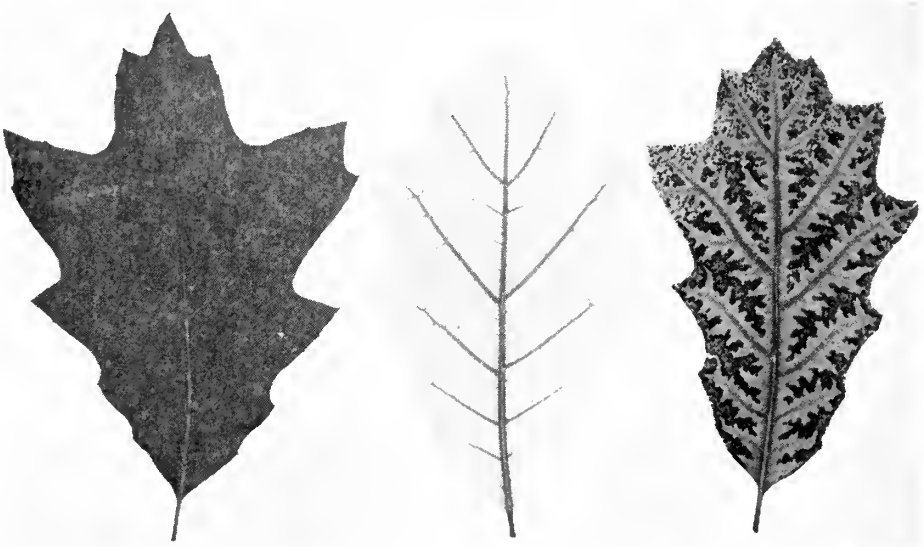
In addition to being susceptible to various fungal and bacterial diseases, trees are also subject to injury by conditions caused by man and nature. Some of these are described below.

Leaf scorch. Street and ornamental trees are often affected by leaf scorch. This malady occurs when trees grow rapidly in the spring followed by high temperatures and little moisture in the summer. Leaves on trees

affected by scorch turn brown in the areas between the veins and along the edges (Fig. 15, right side). Trees showing evidence of scorch should be fertilized and frequently watered.

Chlorosis. Chlorosis results when essential elements such as iron, manganese, magnesium, boron, zinc, and nitrogen that are needed by trees for healthy growth are not available in the soil in sufficient quantities. Leaves on trees affected by chlorosis become yellowish, reddish, or purplish green (Fig. 15, center). Pin oaks and sweetgums are commonly affected. Sometimes chlorotic trees can be cured by iron salts sprayed on the leaves or injected into the trunks. Soil treatment with compounds containing available iron will often result in longer lasting effects. Other elements may also need to be placed into the soil to produce normal growth of the leaves.

Chemical injuries. Trees can be severely injured or killed by chemicals used as weed killers. One such chemical is 2,4-D. Although 2,4-D has been restricted for use in some areas, it still presents a danger to trees, especially if it is used indiscriminately. Leaves of trees injured by 2,4-D curl and grow into abnormal shapes. New growth is often stunted. If a tree has only slight 2,4-D injury, watering and fertilizing will often help it recover. Wait until the following growing season to fertilize. Overfer-



The oak leaf on the left is normal and dark green in color. The leaf in the middle is afflicted with chlorosis and is light yellowish green. The leaf on the right has been scorched. The areas near the veins are light tan in color. (Fig. 15)

Table 1. — Amounts of Fertilizer to Apply to Shade Trees

Fertilizer	Application per 1,000 square feet	Diameter of feeding circle in feet								
		8	10	12	16	20	25	30	35	40
	pounds	pounds-ounces								
Nitrogen (N)										
Urea (45 percent N)	13	0–10	1–0	1–8	2–10	4–2	6–8	9–3	12–8	16–6
Ammonium nitrate (33.5 percent N)	18	0–14	1–7	2–1	3–10	5–11	8–13	12–12	17–4	22–10
Ammonium sulfate (21 percent N)	29	1–7	2–4	3–5	5–14	9–2	14–4	20–8	27–13	36–8
Phosphorus (P)										
Superphosphate (20 percent P_2O_5)	18	0–14	1–7	2–1	3–10	5–11	8–13	12–12	17–4	22–10
Double superphosphate (40 percent P_2O_5)	9	0–7	0–11	1–0	1–13	2–13	4–6	6–6	8–12	11–5
Potassium (K)										
Muriate of potash (60 percent K_2O)	10	0–8	0–13	1–2	2–0	3–2	4–15	7–1	9–10	12–9
NPK mixture (water soluble, liquid applied)										
20–20–20	30	1–8	2–6	3–6	6–0	9–6	14–11	21–4	28–13	37–10
23–19–17	26	1–5	2–1	2–15	5–4	8–3	13–0	18–6	25–0	32–10
25–10–20	24	1–3	1–14	2–11	4–13	7–9	11–12	17–0	23–0	30–2
(non-water soluble, applied as powder or granules)										
10–10–10	60	3–0	4–11	6–12	12–0	18–14	29–6	42–6	57–10	75–6
12–12–12	50	2–8	3–15	5–11	10–0	15–12	24–8	35–5	48–0	62–13

tilization, however, must be avoided. Trees can be injured because roots are burned by overfertilizing. Follow the instructions in Table 1 to determine the amount of fertilizer to use in order to avoid underfertilizing or overfertilizing. Also be sure to observe the precautions and other instructions given on the fertilizer bag.

Trees can also be killed if gas pipes near the roots leak. This causes the soil air to be displaced and the tree roots consequently suffocate. The leak should be stopped as soon as it is detected or the tree will die in a short time.

Dieback. This is a fairly common tree problem. It is caused by a decrease in the available food and water supply. When dieback is present, tips of branches and tops of trees become leafless (Fig. 16). Sometimes dieback can be controlled by pruning affected branches. Fertilizing and watering after pruning will also help the tree to regain vigor.

Extensive dieback on a shade tree. Every branch in the upper part of the tree has leafless dead twigs. Such a tree needs immediate feeding and watering. (Fig. 16)

Compaction of soil. Soil that is compacted by people or animals walking under trees will allow less water to reach tree roots, disturb aeration, and generally worsen the tree's growing environment. Leaves of affected trees are undersized and twigs show very slow growth. Watering and fertilizing will help but excessive traffic under trees should be eliminated as the first control measure.

Ice and hail injuries. Heavy coatings of ice on trees will result in limb breakage and sometimes in the breakage of an entire tree. When a branch breaks off as the result of ice accumulation, the wound should be smoothed and treated with a dressing. Use a chisel and mallet to cut away the rough surface.

Hail damages all types of trees but is most injurious to new growths on coniferous trees. Scar tissues on young twigs are an indication of hail damage. No wound dressings are needed on coniferous trees because their wounds exude a pitch that helps to protect the surface.

Temperature extremes. Sunscalding occurs in late winter as a result of higher temperatures during the day and sharply lower temperatures at night. As a result, the cambium is killed on south and west sides of trunks of exposed thin-barked trees (Fig. 17). Wood-rot fungus may then infect the sapwood. Dead bark and rotting wood should be removed and a dressing containing a disinfectant such as rubbing alcohol should be applied. Wrapping of the trunks is recommended especially when transplanting trees 1 inch in diameter or larger.

The thin bark of this tuliptree was killed by extreme temperature ranges in late winter. The dead bark was removed and wound dressing and alcohol was applied to prevent decay. (Fig. 17)

Late spring or early fall frosts can kill new evergreen growth. This can result in stunting a tree's growth, but new growth will usually appear the next growing season. When the temperature is rising, dry winter winds can cause foliage to turn brown and die. Enclosing evergreen trees that are known to be sensitive to winter burning with a protective wrap and mulching them are helpful ways to prevent burning.

Flooding. Poorly drained soils can result in insufficient aeration for roots and in the death of trees. Few species can withstand drowning of the roots. Trees can withstand flash floods if the water drains off in a few hours. Most evergreens cannot stand having "wet feet" for any length of time, especially in the spring when growth begins.

CONTROLLING WEED TREES IN PLANTATIONS

Weed trees are "volunteers" that grow in forest plantations and windbreaks. They are a result of seeding by birds and squirrels, dispersal by wind, sprouts from roots, or seed stored in the ground. These trees interfere with the growth of plantation trees and with fences and areas where trees are not wanted. Even a black walnut, the most valuable hardwood in Illinois, can be a weed tree in a Christmas tree or pine plantation. Cutting down weed trees usually affords little relief because they often sprout and grow back.

Note: 2,4,5-T must not be used around the home, lakes, ponds, ditchbanks, and food crops. Use this chemical only in treating weed trees in plantations.

Herbicides are useful for controlling weed trees. A solution of 2,4,5-T (use the ester form) mixed with fuel oil or kerosene will kill most species of weed trees. To prepare the solution, use one pint of 2,4,5-T for each 3 gallons of fuel oil or kerosene. This mixture is at the rate of 4 pounds of actual acid equivalent of 2,4,5-T in 25 gallons of fuel oil or kerosene. Check the rate on the can before preparing the solution. Be sure to mix the solution well. It is better to spray weed trees before planting an area and it is easier to treat weed trees where no other trees are growing. If weed trees need to be sprayed after other trees are planted, be careful not to spray the plantation trees. If there is a wind, take advantage of the drift to carry the spray onto the trunk of the weed tree and away from the plantation trees. A guard may have to be used to keep spray away from the plantation trees.

The solution should be applied to the trunk with a sprayer. Foliage sprays are not recommended. Trees with trunks up to 8 inches in diameter should be treated by thoroughly wetting the 18-inch section of the trunk immediately above ground. The solution should be applied to the point of runoff. For trees with trunks more than 8 inches in diameter, a frill (a series of downward cuts into the wood) should be chopped completely around the base of the trunk. The solution should then be sprayed into the frill allowing it to flow freely into the cuts until it flows over the top.

For best results, weed trees should not be killed during the growing season. Very late winter when the temperature is well above freezing is a good time to spray. Any equipment that has been used to spray 2,4,5-T should not be used to spray other herbicides or insecticides because residues of 2,4,5-T cannot be entirely removed from the equipment.

CONTROLLING WEEDS IN FOREST PLANTINGS

Dense weeds in young forest plantations are often a problem. Competition between trees and weeds for available moisture and light is the cause. Small trees may die or become stunted and their needles and leaves may be short and unthrifty, changing in color from green to yellow or brown. As winter approaches, tall weeds left growing close to planted trees will tend to fall over and smother the trees. Young Christmas trees are particularly susceptible to needle loss on their lower branches as a result of competition from weeds. Continued competition from weeds will cause most trees to die during the second season after planting.

Weeds can be controlled by mowing or by chemicals. Tall weeds can be mowed if the location of small trees is known exactly so that they are not cut down accidentally. The planting can be marked by stakes at the time of planting and when there are no tall weeds present. Then the stakes can be followed as guides when weeds are being mowed. Mower blades should be kept away from tree trunks and a few weeds can be left about 12 inches from tree trunks to help shade small trees.

Dense stands of weeds should not be mowed in July or August. At this time of year the weeds shade small trees from the hot sun. If all the weeds are removed, the trees might die as a result of sudden exposure to the heat. If weeds are mowed earlier in the summer when they are short, trees will be able to adjust gradually to more light and higher temperatures. More than one mowing may be necessary to keep weeds down. To facilitate mowing, spacing between trees can be adjusted at planting time to allow for easy use of mowing equipment in the future.

Herbicides can also be used to control weeds near trees. Simazine *used*

at recommended rates will not injure *conifers* even if it comes in contact with the needles when sprayed or dropped in the granular form. It will control most annual broadleaf weeds and bluegrass if it is applied when trees are planted. If simazine is applied early, rainfall will help introduce the herbicide into the surface layer of the soil and the weed seeds that are beginning to germinate will die.

A fertilizer or seed spreader can be used to apply simazine granules. If there are only a few trees where the herbicide is to be applied, a shaker to spread the granules can be made from a gallon can with an attached handle. Holes punched into the bottom of the can will allow the granules to drop. If a spreader is used, it should be set to allow the granules to drop in a band either 18 or 24 inches wide over the tree row. If a shaker can such as the one described above is used, the granules should be dropped in a 2-foot circular area around the tree.

Simazine should be applied at about 3 to 6 pounds of the actual ingredient per acre. On sandy soils, a rate of 3 or 4 is adequate. On clay and silt soils or where control for two years is desired, a rate of 5 or 6 pounds should be used. Simazine is also available in the wettable form. A 2- to 3-gallon backpack sprayer can be used to spread it in a water solution.

PRUNING FOREST PLANTATIONS

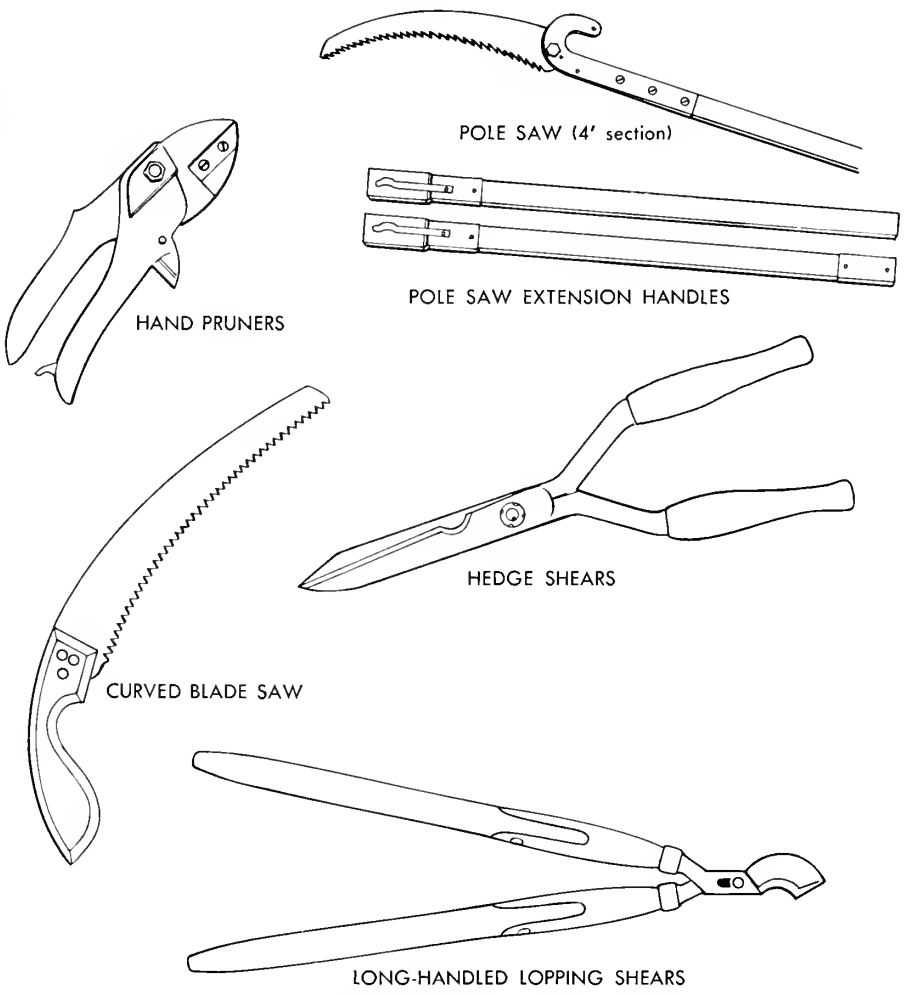
Trees in forest plantations are pruned to produce knot-free wood. This kind of wood produces stronger and more attractive lumber and consequently commands a higher price. Trees that are to be harvested for posts should be pruned at least five years before they are cut down. Trees left growing to produce lumber should have branches pruned when the trunks are 3 to 6 inches in diameter. This will result in a higher percentage of knot-free lumber. Pruning can also help keep any fire that might start in the plantation under control. If there are no branches near the ground, slow-moving fires will not be able to reach crowns of trees. Fire that reaches a tree's crown will almost always kill the tree.

A common way of pruning a forest plantation is to cut off limbs up to a certain height on all trees in a stand. The greens (limbs with live foliage) can be left on the ground to form a mulch or they can be used for decorative purposes at certain times of the year.

An alternate way is to prune only those trees that are expected to eventually be harvested for crop. Although all trees that reach a marketable size might be considered crop trees, many poorly formed trees are often not harvested. Pruning these trees for marketing purposes thus is a waste of effort. However, they can be pruned up to about eye level as a protective measure against fires.

Pruning Tools

Basic pruning tools include a curved-blade saw about 14 inches long and a long-handled lopping pruner. The saw makes it possible to prune large limbs and to prune close to the trunk while the lopping pruner is easier to use on small limbs and makes a smoother cut. A ladder should be used if pruning has to be down above eye level or sectional extension handles are available that make it possible to prune limbs up to 17 feet high from the ground. Hand pruners and hedge shears are used on small trees and shrubs. These tools are shown in Figure 18.

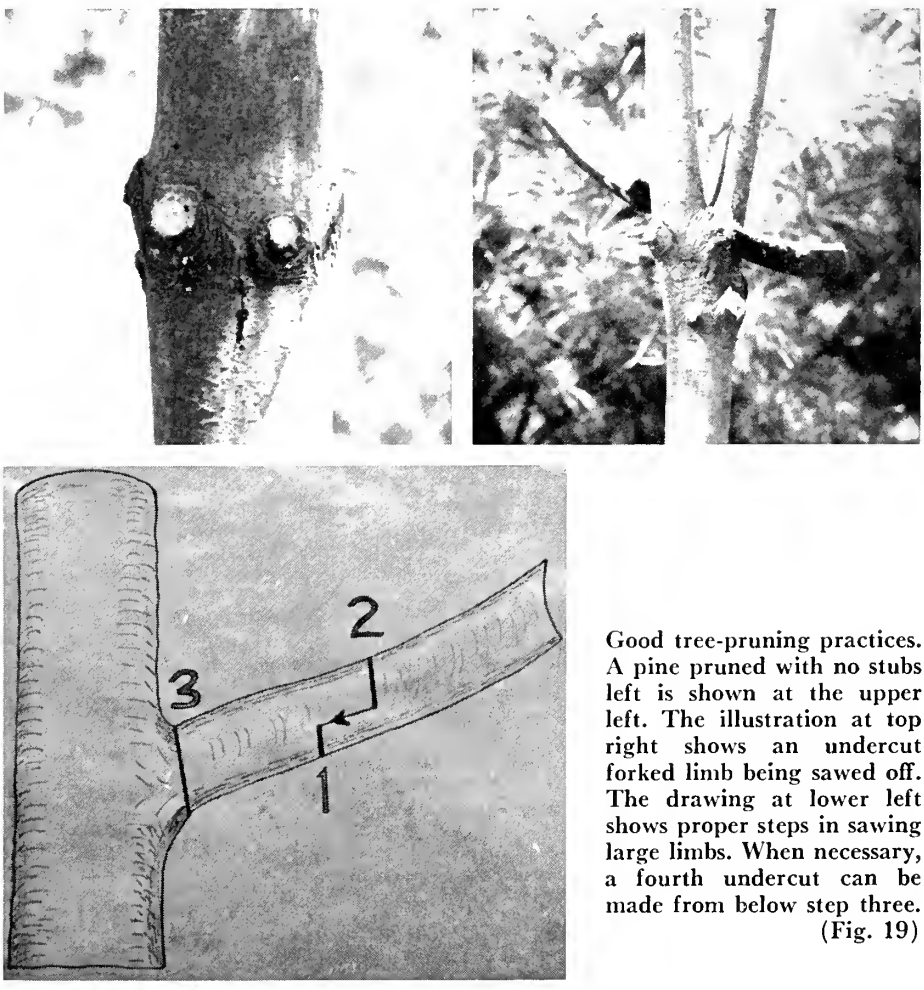


Tools for pruning shade, windbreak, and pine trees and for shaping Christmas trees. (Fig. 18)

Tools need care if they are to be used efficiently and safely. All tools should be cleaned after use. Cutting edges should be periodically treated with oil to prevent them from rusting. Dull blades can be sharpened on a whetstone but care should be taken not to overheat the blades because overheated metal can lose its temper.

Pruning Pine Trees

Pines can be pruned at any time of the year. However, it is better to avoid pruning loblolly and shortleaf pines in southern Illinois during the spring and summer to keep beetles from attacking the trees. Plantation pines can be pruned as soon as the tree is 12 feet tall but pruning is often delayed until a height of 18 feet is reached. However, if pruning is started earlier, more knot-free lumber will be the eventual result.



Good tree-pruning practices. A pine pruned with no stubs left is shown at the upper left. The illustration at top right shows an undercut forked limb being sawed off. The drawing at lower left shows proper steps in sawing large limbs. When necessary, a fourth undercut can be made from below step three. (Fig. 19)

The pruning practices shown in these illustrations should be avoided. At left a limb has been pruned off too close leaving a large wound. The center illustration shows stubs left with bark scraped off by the saw. The tree in the right illustration has had bark stripped below the cut leaving a large, slow-healing wound.
(Fig. 20)

Mature pine trees are usually pruned free of branches to a height of 17 feet. This allows for a 16-foot log with a 1-foot stump remaining. Not more than half of the live crown should be pruned off at any one time. If there are live branches to the ground, only one-third of the total height should be pruned. All dead lower branches can be pruned as well as one or two whorls of live branches. Figure 19 shows some correct pruning techniques and Figure 20 shows some pruning mistakes.

CARE OF SHADE, WINDBREAK, AND SHELTERBELT TREES

Pruning Shade Trees

Newly planted shade trees usually need to be pruned. Branches should be removed to balance the crown of the tree with the root system which has lost some roots during the transplanting process. Below are some suggestions for pruning shade trees.

- Cut out all dead and broken branches.
- Thin out branches when they touch one another. Weak and short branches should be removed.

- Remove the lowest branches first.
- Prune out extra main leaders, leaving the one nearest the center. This one is usually also the largest.
- Avoid pruning trees that have very few branches. Greater root development will occur where sufficient leaf surface is allowed to remain and a more thrifty tree will be the result.
- Avoid pruning maples, walnuts, and any other trees from which the sap bleeds in late winter. Wait until late spring or summer when the sap run has stopped.

Older trees also need attention. In addition to the removal of dead, broken branches and the thinning of branches, an inspection should be made before growth begins in the spring to see if additional lower branches need to be removed. Branches that rub against power and telephone lines should be pruned off. Telephone and power companies will sometimes prune such branches if they are informed of the situation. For additional information on shade trees, see Circular 1033, Pruning Evergreens and Deciduous Trees and Shrubs.

Pruning Windbreak and Shelterbelt Trees

If there is more than one leader on a tree, the least desirable one should be pruned off. Cuts should be made close to the trunk because extra leaders will grow back unless the branch is completely cut out. Extra leaders should be removed yearly for as long as they can be conveniently reached.

Spruce and fir usually grow to produce a dense type of tree. Many of them are fairly well balanced and may not need shaping. However, some poorly shaped trees can be corrected when they are young by cutting back side branches to balance them with branches on the opposite side of the tree. Pruning should be done at the point where limbs branch or just above or outside of a strong or larger bud. Windbreaks should be pruned when they are small to avoid cutting out large sections of branches. It is also wise to check windbreak and shelterbelt trees once a year to see if any trees need pruning, fertilizing, or mulching.

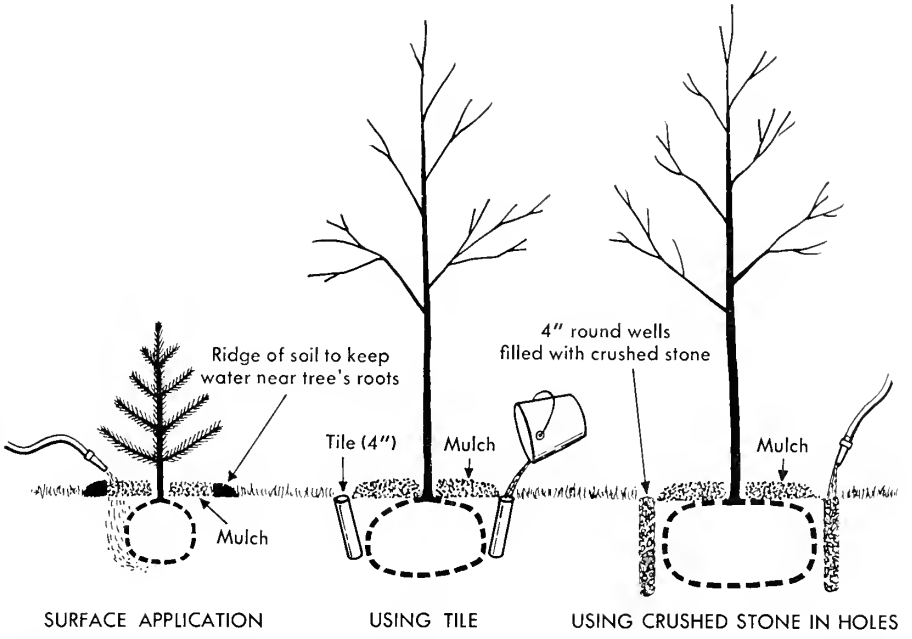
Watering Shade and Windbreak Trees

Trees should be watered during drouthy periods for the first two years after planting. Older trees also need watering if the drouth lasts for more than two months. Watering is definitely needed if cracks appear in the soil and leaves and needles of trees start to wilt, curl, or change color. Less watering will be needed as a tree grows and roots penetrate deeper into the soil where there is usually more moisture.

Windbreak trees less than 2 feet tall should receive at least 10 gallons of water twice a week until sufficient rain falls. Trees from 2 to 5 feet tall need 15 to 25 gallons of water twice a week. Shade trees about 10 feet tall should get at least 25 gallons of water a week and 15- to 20-foot shade trees need between 30 and 50 gallons. If there is little or no rain during the fall, young windbreak and shade trees should be watered to soak the soil down to the main roots. This will help to reduce the browning and burning of needles. Figure 21 shows some methods of watering trees. Established shade trees two or more years old should be supplied with the equivalent of 2 inches of rainfall once every two weeks during prolonged drouthy periods.

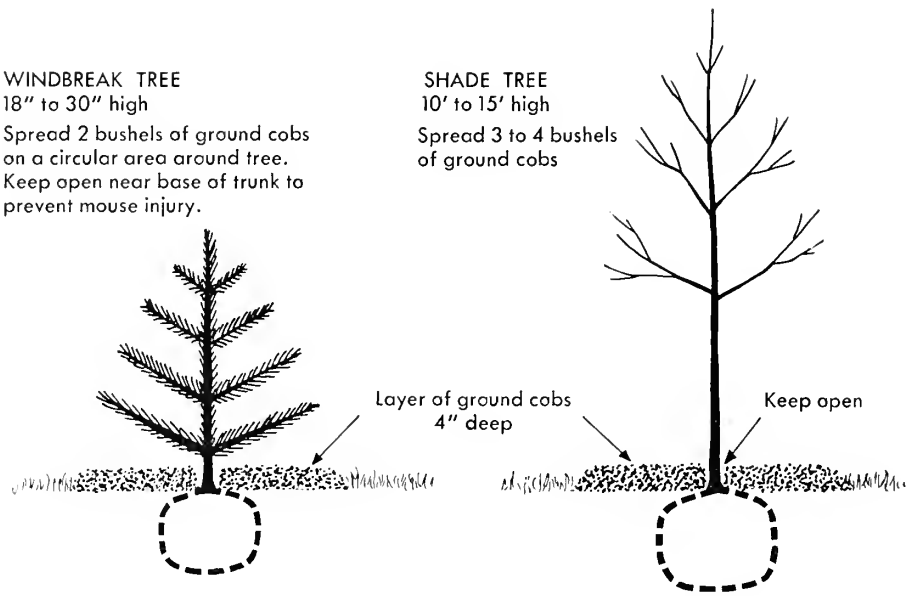
Mulching Shade and Windbreak Trees

All windbreak and shade trees should be mulched after planting. A mulch acts as a protective blanket on soil around trees and helps hold moisture in the soil for a longer period than would be the case if the soil was exposed to the wind and sun. Mulch keeps weeds from growing close to trees and keeps the temperature of the soil around the tree roots more even both in the summer and the winter. Transplanting shock is also lessened by using a mulch.



Methods of watering shade and windbreak trees. **(Fig. 21)**

Ground cobs and straw are the best mulches for trees. Wood chips and bark also make good mulch material. Hay and leaves are sometimes used but they do not provide as much insulation as cobs or straw because they tend to pack down and become a part of the soil. Cobs should be ground ⅜ inch or slightly smaller and spread to a depth of at least 4 inches. Straw can be spread about 6 inches deep before it settles. When the mulch under trees packs or settles down to an inch or less, becomes part of the soil, or blows away, replace it with new mulch. The mulch around windbreak and shade trees should be checked in the fall and spring following planting to see if there is sufficient material to provide protection for at least the first two years. Figure 22 shows some suggested ways of applying mulches.


WINDBREAK TREE
18" to 30" high
Spread 2 bushels of ground cobs on a circular area around tree. Keep open near base of trunk to prevent mouse injury.
SHADE TREE
10' to 15' high
Spread 3 to 4 bushels of ground cobs
Layer of ground cobs 4" deep
Keep open

Methods of mulching newly planted windbreak and shade trees. **(Fig. 22)**

Wrapping Trunks of Newly Planted Trees

Sunscald and insect injury to trunks of recently planted shade trees can be prevented by wrapping heavy paper around the trunks. Wind the paper in strips about 3 inches wide spirally around the trunk from the ground to the lowest branch. To prevent the paper from loosening, use twine or cord tying half hitches as you progress from the ground upward. The paper and cord should be removed before growth starts the third year after planting.

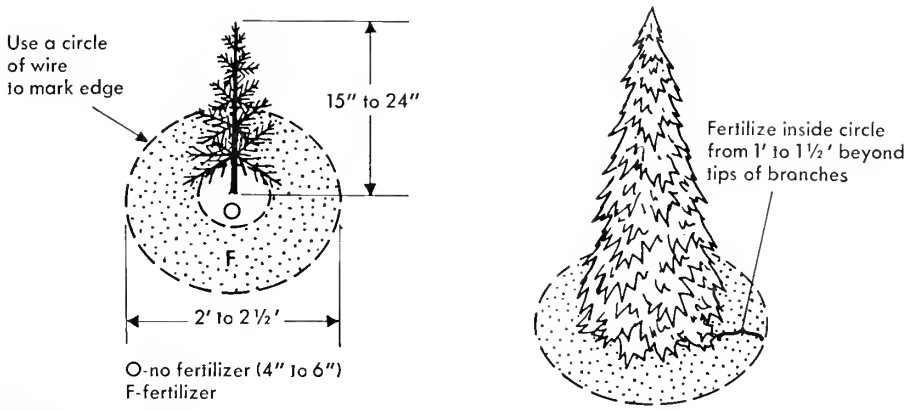
Fertilizing Shade and Windbreak Trees

Applications of fertilizer will often help a tree that is slow in growth or whose vigor is low. Growth is usually slow after transplanting and is likely to increase after the second season. If growth is still slow at this time, fertilization should be considered. Low vigor is indicated by off-color leaves or needles and by abnormal loss of foliage. Fertilization may help restore vigor in such trees.

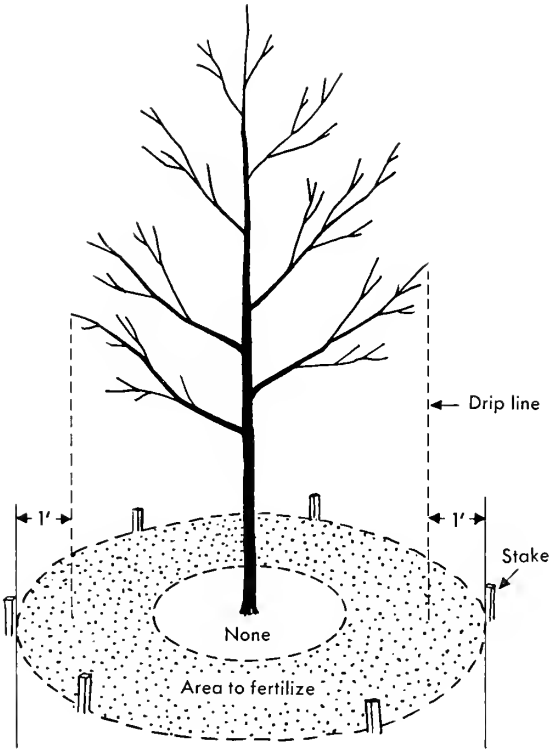
Fertilizer should be applied preferably in the early spring before leaves appear. It can also be applied up to July if the trees are watered.

A general-purpose fertilizer containing nitrogen, phosphorus, and potash is recommended for fertilizing trees. Such a fertilizer can be spread on the surface of the soil or, where quicker results are desired, can be placed in holes in the soil. Figure 23 shows suggested methods for fertilizing evergreen and windbreak trees. Figure 24 shows how to fertilize shade trees.

All fertilizers are manufactured and marketed at certain stated percentages of nitrogen, phosphorus, and potassium. These percentages must be stated on the fertilizer bag. For example, if the fertilizer bag gives an analysis of 10-8-6, the fertilizer contains 10 percent nitrogen, 8 percent phosphorus, and 6 percent potassium, all by weight. The remaining 76



Methods of fertilizing evergreen and windbreak trees. Use the following rates of application. For a smaller tree such as the one shown at the left, apply 10-8-6 or 10-6-4 formulated fertilizer at the rate of 1 to 1½ ounces by weight or ⅛ to ¼ cup by volume per tree. For a larger tree such as the one shown at right, apply the following amounts of fertilizer by weight according to the tree height indicated: 3 feet — ¼ pound; 4 feet — ⅜ pound; 5 feet — 1 pound; 6 feet — 1½ pounds; 7 feet — 2 pounds; 8 feet — 2½ pounds. For trees larger than this, apply 2 pounds per inch of trunk diameter at about 4 feet above the ground. (Fig. 23)



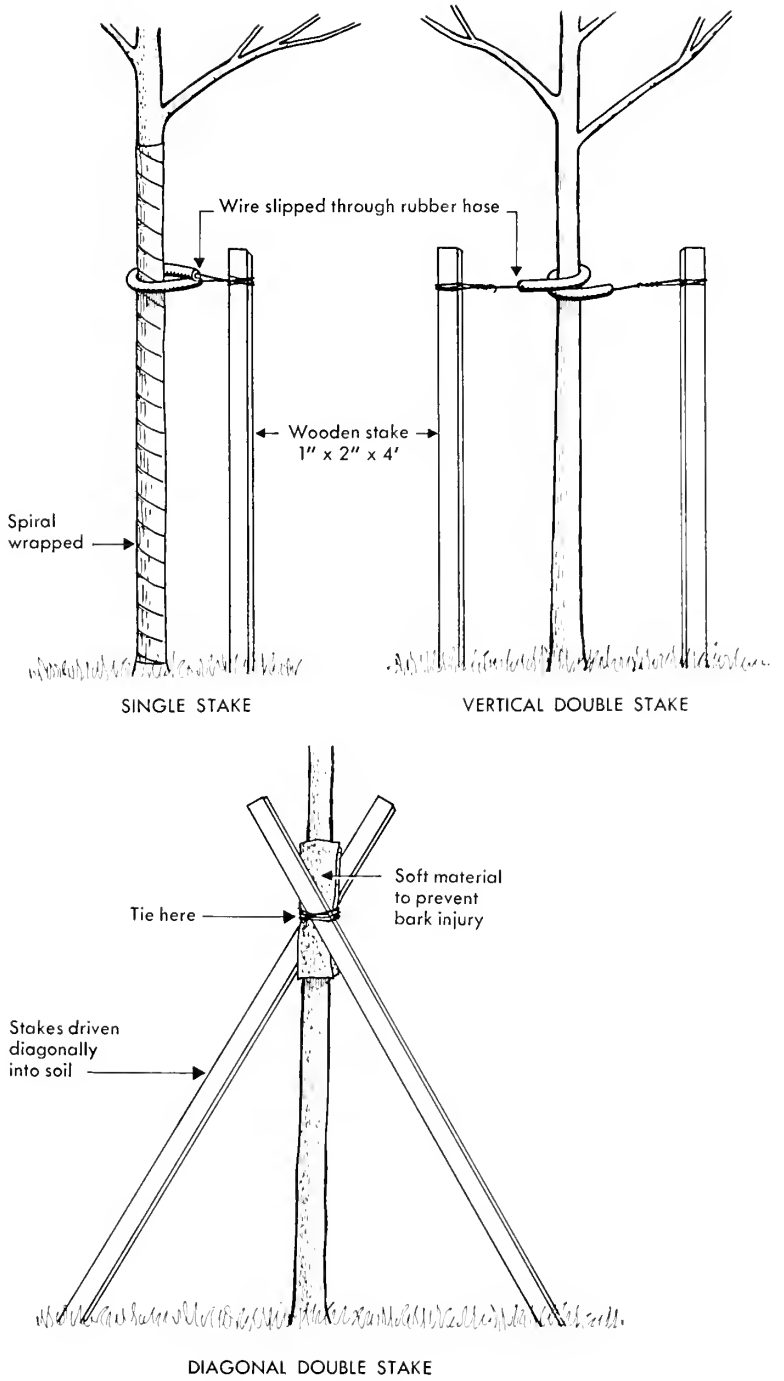
To fertilize a shade tree by surface application, treat the shaded area shown in the drawing. For quicker results, holes can be punched in the area 2 feet apart and 18 inches deep. (Fig. 24)

percent is an inert carrier. An analysis of 10-0-0 means that the bag contains a fertilizer with 10 percent nitrogen, no phosphorus or potassium, and 90 percent inert carrier.

The caption for Figure 23 gives suggested amounts of fertilizer to apply for evergreen and windbreak trees of different sizes. See Table 1 on page 19 for shade trees.

The amounts of fertilizer to be applied given in Table 1 are for circular areas. If a rectangular area around a tree is to be fertilized, 25 percent should be added to the amounts given in Table 1 for the size of feeding area in question. For example, if instead of fertilizing a 12-foot circle around a tree, you wish to fertilize a 12-foot square area with a 10-10-10 fertilizer, use 1 and ¼ times the recommended amount in Table 1 (6 pounds, 12 ounces). The amount to use for a square area is 8 pounds, 7 ounces.

Additional information on fertilizing and watering may be found in Illinois Natural History Circular 52, Fertilizing and Watering Trees. This may be obtained from the Illinois Natural History Survey, Natural Resources Building, Urbana, Illinois 61801.



Methods of supporting newly planted trees. **(Fig. 25)**

Staking Newly Planted Shade Trees

After a newly planted tree is watered, fertilized, and mulched, and the trunk is wrapped, it should be protected from wind damage by guy wires and stakes. Parts of wires that go around the trunk or branches should be covered by a plastic or rubber hose to avoid injury to the tree. Figure 25 shows suggested ways of staking newly planted shade trees.

Treating Wounds of Shade Trees

Wounds in tree trunks are often caused by careless handling of tractors, mowers, and automobiles. Farm animals also often tear off bark and low limbs if trees in pastures are not protected by a fence. Insects, diseases, and extreme temperatures are other causes of trees losing their bark and of sapwood and heartwood being exposed to extreme weathering and decay. Eventually large unprotected wounds result in excessive decay of the trunk, weakening it to a point where both branch and trunk breakage can occur during high winds.

Wounds of the bark on trunks and branches can be treated with a minimum of labor and expense if the work is done soon after the injuries occur. Wounds should be cleaned up at the edges of the damaged bark area. The exposed wood should also be cleaned up of frayed parts. Use a chisel to smooth over the wood and allow the new callus growth to form well. All decayed wood should be removed and a protective dressing should be applied with a brush to the wound. A commercial dressing containing asphalt is best. Other dressings sometimes used are spar varnish or paint to which a fungicide such as copper sulfate is added. The coating should provide sufficient protection for at least one year. Wounds on small branches need only one coating but wounds on larger branches may need to be recoated. Check wounds annually to see if recoating is needed.

SHAPING PINE CHRISTMAS TREES

If Christmas trees in a plantation are grown for sale, some shaping of the trees will be required to make them more attractive to the buyer. Most buyers look for trees that have reasonably dense foliage and that are well balanced and more or less conically shaped. A Christmas tree ready for sale should have been shaped but should look like it has not been. The twigs and needles should have a natural appearance.

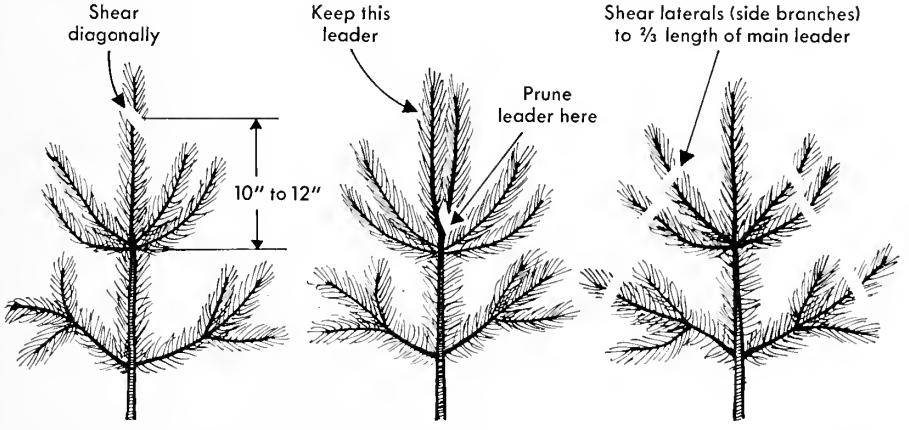
It is possible to increase the number of high-quality trees grown in plantations from as low as 10 percent to as high as 80 percent. Shaping will result in at least 50 percent good- to high-quality trees in most Christmas tree plantations. The object of shaping is to prevent Christmas trees from

growing too fast with resulting large openings and lopsided or multiple-leadered trees. If the current growth of the main leader and the side branches are sheared during the late spring or very early summer, more buds are produced than if the tree had not been sheared. As a result, in most pine species more branches appear during the following year's growing season than would have otherwise been the case. These extra branches help fill the larger openings. Shearing off the main leader or trunk of fast-growing trees reduces the distances between whorls and branches and in filling in many of the openings often seen in leggy, fast-growing trees. If a tree is lopsided with extra-long branches on one side, removal of the outer parts of these branches will help to balance the tree.

Shaping of a pine for a Christmas tree should start when the tree is about 3 feet tall. The best time to do the work is during the early summer — late May and June in southern Illinois and also during part of July in the northern part of the state. Avoid shearing white pine after late June because the main leader could die back causing a flat-topped tree. Many trees will need some shaping every year until they are harvested. Extra caution should be used when a Christmas tree is sheared in the year when it is to be harvested. As many branches as possible should be left uncut in order to make the tree appear more natural. Extra main leaders should be pruned out, the main leader should be shortened if it is abnormally long, and side branches and twigs should be cut back where necessary to give the tree balance.

Figure 26 shows suggested practices in shaping Christmas trees. Steps to follow in the shaping are described below.

The main leader should be pruned first. If it is more than 10 inches long, it should be pruned to about 10 inches. Trees more than 5 or 6 feet



Methods of shaping pine Christmas trees. **(Fig. 26)**

tall can have main leaders more than 12 inches long. The main leader should be pruned with a diagonal cut to encourage a large leader bud to grow as high as possible. In many cases a single leader will outgrow shoots from smaller buds.

The first set of side branches below the leader should be pruned next. These branches should not be more than two-thirds the length of the main leader.

Branches down the side of the crown should be cut next where necessary to form a cone and produce a balanced, symmetrical tree.

Lopsided trees may need to be sheared back into the previous year's growth to balance the tree. If possible, growth on twigs on each side of the cut should be kept to fill in areas where deep shearing has been done.

Short growth should not be sheared too close if it has not filled or grown in as desired. Such short branches should be allowed to grow and fill in for one season. Scotch pine may need some thinning of branches in the top whorl to strengthen the remaining ones.

REFERENCES

The following publications offer additional information. If you wish to obtain them, write to the source listed for each. Single copies are free, except for the last two items.

Controlling Weeds With Selected Herbicides in Forest and Christmas Tree Plantations. Department of Forestry, University of Illinois, Urbana, Ill. 61801.

Fertilizing and Watering Trees. Ill. Natural History Survey Circ. 52. Illinois Natural History Survey, Urbana, Ill. 61801.

Illinois Trees: Selection, Planting, and Care. Ill. Natural History Survey Circ. 51. Illinois Natural History Survey, Urbana, Ill. 61801.

Illinois Trees: Their Diseases. Ill. Natural History Survey Circ. 46. Illinois Natural History Survey, Urbana, Ill. 61801.

Illinois Trees and Shrubs: Their Insect Enemies. Ill. Natural History Survey Circ. 47. Illinois Natural History Survey, Urbana, Ill. 61801.

Insect Control by the Homeowner. Univ. of Ill. Coop. Ext. Service Circ. 900. Publications Office, 123 Mumford Hall, Urbana, Illinois 61801.

Knots Versus Clear Lumber. U.S. Forest Products Laboratory, Madison, Wis. 53703.

Knowing and Controlling Insects. Univ. of Ill. Coop. Ext. Service Circ. 746. Publications Office, 123 Mumford Hall, Urbana, Ill. 61801.

Pruning Evergreens and Deciduous Trees and Shrubs. Univ. of Ill. Coop. Ext. Service Circ. 1033. Publications Office, 123 Mumford Hall, Urbana, Ill. 61801.

Tree Care. By J. M. Haller. The Macmillan Co., New York, N.Y.

Tree Maintenance. By P. P. Pirone. Oxford University Press, New York, N.Y.

Advice on tree care can also be obtained from your county extension office and from commercial nurseries.

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